tic origin, the subject becomes of more than passing interest for the French anthropologists.

Mr. Salmon outstrips all competitors in the *finesse* of his chart of archæology, in that region of guesswork where six blind men of Hindustan went out to see the elephant. Here it is:

I. Age of stone.	Period I. Stone flaked by fire,	Tertiary.
	Period II. Chipped stone,	Quaternary.
	a. Epoque Chelleènne or Acheulèen,	"
	b. Epoque moustèrienne,	"
	c. Epoque solutreènne,	
	d. Epoque magdalenienne,	"
	Period III. Polished stone,	Recent.
II. Age of bronze,		"
III. Age of iron,		"

Age I, Period I, is then elaborated, p. 451, into thirteen stages extending from the Lower Miocene to the Upper Pliocene.

M. Lejean's paper is continued from pp. 201–259 of this volume, and is indispensable to the ethnologist.

The purport of Dr. Arno's paper is sufficiently explained by the title.

On p. 520 M. Manouvrier reviews Hovelacque's "Les Races Humaines," The author divides our race primarily into Australians, Papuans, Melanesians, Bushmen, Hottentots, Guinea and Soudan Negroes, Akkas, Kaffirs, Peuls and Nubians, Negritoes, Veddahs, Dravidians, Moundas (savages of Indo-China), Siamese, Birmans, Himalayans, Indo-Chinese (east and south), Chinese, Japanese, Aïnos, Hyperboreans, Mongolians, Malays, Polynesians, Americans, Caucasians, Berbers, Semites, Aryans (Asiatic and European).

On p. 527 is a short sketch of M. Emile Houzé's studies on the crania of Flamands and Wallons. The prehistoric Belgians are neatly set forth in the following scheme:

Age of stone	Palæolithic epoch	Age of the mammoth	Race of Engis, Dolicocephalic.
			" " Naulette, "
		do. of reindeer	" " Furfooz, Sub-brachyceph'c.
	Neolithic epoch		" " Sclaigneaux, Brachyceph'c.
			" " Chauvaux, Dolicocephalic.
Age of metal, represented archæologically by	Eygenbilsen, limit of the bronze and the iron age.		
	Louette-Saint-Pierre?		
	Lustin, province of Namur?		

MICROSCOPY.[1]

ORIENTATION IN MICROTOMIC SECTIONS.—If any organic object has been cut ("microtomized") into serial sections and mounted, the value of the series for microscopical investigation will depend not only on the success with which each step in the preparation has been attended, but also on our ability to grasp all the topographical relations of each section. It is not enough to know the *region* through which a section passes; we must have the means

[1] Edited by Dr. C. O. WHITMAN, Newton Highlands, Mass.

of ascertaining to within a very small fraction of a millimeter, the exact path of the knife. Such precise orientation can only be arrived at in an indirect way; but the improved instruments and methods of section-cutting make its attainment a no very difficult task. To determine the *locus* of sections with accuracy, several conditions must be fulfilled. The sections must be made of *uniform thickness*, arranged in *serial order*, and all *similarly disposed*. With these conditions satisfied, the *plane of section* determined, and an accurate surface view of the object obtained prior to imbedding, it becomes an extremely simple matter to know what portion of the surface view is represented by any given section. The following data will furnish an illustration:

Blastoderm of the chick, 5^{mm} long.
Surface view magnified 20 diameters.
Thickness of each section $.05^{mm}$.
Plane of section at right angles to the long axis of the blastoderm.

From these data we know that there should be just 100 sections, and that each section must correspond to 1^{mm} of the surface view.

Now if we draw a line at one side of the surface view, parallel to, and of equal length with, its long axis, and divide this line into 100 equal parts, the number of the section will correspond to the same number on the scale, and the exact position of the section be recognized at a glance.

Of the conditions above named as essential to an exact knowledge of the locus of any given section, the only one likely to present any serious difficulties is that of obtaining sections of uniform thickness. Where the object-carrier and vernier are combined, and moved directly by the hand, it is extremely difficult, if not impossible, to obtain that degree of uniformity required for exact topographical study. In the best microtomes now in use, the carrier is moved only indirectly by the hand, through a micrometer screw, and its movements are thus brought under perfect control. Some space will be devoted later to the description of a microtome[1] which presents many important improvements on the old Rivet-Leiser microtome improvements that have originated with the gentlemen who are now associated in the management of the Zoölogical Station of Naples.

THE RECONSTRUCTION OF OBJECTS FROM SECTIONS.—The importance of attending to all available means of orientation will be best understood by those who know how to make use of sections in the reconstruction of objects or parts of objects. Suppose the only material at the disposal of an investigator to be a single small object, and that the rarity of the object renders its replacement extremely improbable. How shall the object be treated in order that the most exhaustive knowledge of all the details of its inner

[1] This microtome may be obtained from Rudolph Jung, optician and mechanic in Heidelberg.

structure may be obtained? One might be tempted to lock it up as a cabinet rarity, if he did not know how to make a single series of sections tell the whole story. If the preliminary steps have been correctly taken, it is possible to construct from serial transverse sections, a median sagittal (longitudinal and vertical) or frontal section, or a section in any desired plane. From the same series may be constructed also surface views of internal organs, which are inaccessible to, or unmanageable by, any of the ordinary methods of dissection.

It frequently happens that sections can be obtained by construction that could not be obtained by any direct means. For example, we may desire a frontal section of a vertebrate embryo that will show all the parts that lie in the same level with the chorda, or a sagittal section that will represent a median plane. It is evident that no such sections can be directly obtained, owing to the axial curvature of the embryo; but they can easily be constructed from transverse sections. It is here that we see some of the great advantages to be derived from the use of the microtome. It not only overcomes the opacity of objects, but it also enables us to represent curved and twisted surfaces in plane surfaces. The ability to construct sections at right angles to the actual planes of section is the key to the next and final step—"the plastic synthesis" of the sectioned object.

METHOD OF RECONSTRUCTION.—Professor His was the first to make known the method of procedure.[1] Others have since made use of the same method for different purposes. A. Seessel, a former pupil of Professor His, employed it in a work on the development of the fore-gut[2]. Rosenberg made use of it in the contruction of frontal views of the sacrum[3]; and Krieger, in the investigation of the central nerve-system of the crayfish[4]. The method is well illustrated by two figures (11 and 12, Pl. XXXI), given by Krieger; and these figures are well worth examination, as they show how to proceed when the plane of section is not quite at right angles to the axis of the object. Professor His has also constructed frontal and profile (sagittal) views of the human embryo by the same method, and has explained the process in Part 1, p. 10, of his "Anatomie menschlichen Embryonen."

For an illustration, we will take the data given under the head of orientation, and indicate how a surface view could be constructed from a series of transverse sections of the germinal disc of the chick. We should first draw 100 parallel zones on a sheet

[1] His. "Untersuchungen ü. d. erste Anlage des Wirbelthierleibes," p. 182, 1868. "Neu Untersuchungen ü. d. Bildung des Hühnerembryo, in Arch. f. Anat. u Physiol., anat. Abth.," p. 122, 1877.

[2] Seessel "Arch. f. Anat. u. Physiol., anat., Abth.," p. 449, 1877.

[3] Rosenberg Morph. Jahrb. Vol. 1, p. 108, 1875.

[4] Krieger. Zeitschrift f. wiss. Zool. Vol. XXXIII, p. 531, 1880, and Zool. Anzeiger, p. 369, 1878.

of paper, each zone corresponding in thickness to a single section (1^{mm}).

A median line would then be drawn at right angles to these zones; this line would represent the length of the disc magnified 20 diameters (100^{mm}). We should next make an outline drawing of the first section enlarged the same number of diameters as before. The width of this drawing and its parts (primitive streak, embryonic rim, &c.), could then be indicated in the first zone by dots placed at the proper distance on the right and left side of the median line. The dots for each succeeding section having been placed in their corresponding zones, nothing further would remain to be done, except to connect the dots of corresponding parts in the several zones, and shade according to the requirements of the case.

If the plane of section is not quite perpendicular to the axis of the object, one has only to determine the angle which the axis makes with the plane of section, and draw the median line so that it forms the same angle with the parallel zones. Such a case has been clearly illustrated by Krieger.

In the construction of sagittal sections, a profile line (dorsal line, &c.), will serve as the ground line.

THE DIFFUSION OF BACTERIA.—The researches of M. Pasteur and Darwin have shown how earthworms may aid the diffusion of small organisms, some of which may produce disease. Professor Schnetzler states that the dejections of earthworms always contain numerous living bacteria and their germs (the hay-bacterium included). It is clear that bacteria in enormous quantity float in the air about us; and we have at easy command, Professor Schnetzler points out, a small apparatus traversed by about 8000 cubic centimeters of air per minute, which may inform us as to those floating germs. This is no other than the nasal cavity, on the mucous surface of which air particles are deposited. To observe these he advises injecting the nose with distilled water (completely sterilized) by means of a glass syringe previously calcined. The liquid so obtained is put in one perfectly clean watch glass and covered by another. With a microscope magnifying 700 or 800 one finds, among various particles in the liquid, some real live bacteria. If the liquid be kept a few days in a clean glass tube hermetically sealed, the bacteria are found to have increased very considerably. One sees *Bacterium termo*, *Vibrio*, *Spirillum*, *Bacillus subtilis*, even some infusoria, and spores and fragments of fungi. Professor Schnetzler has further successfully cultivated the organized germs by means of a mixture of gelatine and distilled water. Why do not those bacteria in the nasal cavity always multiply and develop and penetrate to the windpipe and lungs? Their progress is doubtless opposed by the vibratory movements of cilia (or minute hairs) in the air-passages, and the weakly alkaline reaction of the nasal mucus may (it is also suggested) be un-

favorable to some of them. Cohn has proved that bacteria producing acid fermentation, perish in liquids with alkaline reaction. Infectious bacteria may, however, multiply to a formidable extent on living mucous surfaces; witness the growth of the micrococcus of diphtheria, brought by the air into the air-passages; also the bacterium of anthrax. The bacillus of tubercle, as Koch has lately shown, may be transmitted from one person to another by the air-passages. Professor Schnetzler thinks hay fever may also be due to bacteria entering the nose. While the development of bacteria on normal mucous surfaces is usually limited, millions of them are found in the dejections of healthy children.—*English Mechanic.*

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS, 1882.—This is a well-printed volume of 300 pages, containing valuable papers on improvements in the microscopes and in histological, botanical and zoölogical topics. Among the microscopical papers are the excellent address of the president, G. E. Blackham on the Evolution of the Modern Microscope; an interesting memoir of Charles A. Spencer, by H. L. Smith, with articles on light and illumination, by E. Gundlach; stereoscopic effects obtained by the high power binocular arrangement of Powell and Lealand, by A. C. Mercer; the improved Griffith Club microscope, by E. H. Griffith; A new freezing microtome, by T. Taylor; Modification of the Wenham half-disc illuminator, with an improved mounting, by R. Dayton; Micro-photography with dry-plates and lamp-light, and its application to making lantern positives, by W. H. Walmsley; The Fasoldt stage micrometer, by T. C. Mendenhall; Osmic acid, its uses and advantages in microscopical investigations, by T. B. Redding. On the conditions of success in the construction and the comparison of standards of length, by W. A. Rogers.

The botanical and general biological papers are: Microscopical contribution; The vegetable nature of croup, by E. Cutter; Micro-organisms in the blood in a case of tetanus, by L. Curtis; Microscopic organisms in the Buffalo water-supply and in Niagara river, by H. Mills; *Rhizosolenia gracilis*, n. sp., by H. L. Smith; Microscopic forms observed in water of Lake Erie, by C. M. Vorce; Sporadic growth of certain diatoms, and the relation thereof to impurities in the water-supply of cities, by J. D. Hyatt.

The zoölogical, histological and physiological papers are on certain crustaceous parasites of fresh-water fishes, by D. S. Kellicott—The termination of the nerves in the liver, by M. L. Holbrook; Observations on the fat cells and connective-tissue corpuscles of Necturus (Menobranchus), by S. H. Gage; The structure of the muscle of the lobster, by M. L. Holbrook; The wheel-like and other spicula of the Chirodota of Bermuda, by F. M. Hamlin; Fresh-water sponge by H. Mills; Polyzoa—Obser-

vations on species detected near Buffalo, N. Y., by D. S. Kellicott.

It would have been a convenience if the papers had been classified.

Destruction of Microscopical Organisms in Potable Water.—Langfeldt, in seeking for a substance which would kill the living organisms without injuring the water for drinking purposes, found that citric acid (½ gram per litre of the water), killed all except Cyclops and those with a thick epidermis, within two minutes.

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SCIENTIFIC NEWS.

— In his interesting sketch of the progress of American mineralogy, delivered before the American Association for the Advancement of Science, at Montreal, Professor G. J. Brush, after speaking of the survey of the country adjacent to the Erie canal in 1820–24 by Professor Amos Eaton, who was placed in charge of the Rensselaer Polytechnic Institute, at Troy, says: "It may be interesting here, in these days of summer schools, to recall, although parenthetically, that what was probably the first summer school of science in the United States, was established more than fifty years ago in connection with this institution. The school consisted of a flotilla of towed canal boats, and the route was from Troy to Lake Erie. It took two months for the trip, and all important points on the way were visited. Instruction by lectures and examinations was given in mineralogy, geology, botany, zoology, chemistry, experimental philosophy and practical mathematics, particularly land surveying, harbor surveying and engineering." One of the largest boats in the flotilla was fitted up as a laboratory, with cabinets in mineralogy and geology, and also scientific books for reference. The students were taught the method of procuring specimens, and were required to make collections of whatever was interesting on the route.

— The Agassiz Association, an organization started by the *St. Nicholas* magazine, for the promotion of the study of nature by children, now numbers 3400 members. There are chapters in all our large cities and in our towns and villages. The aim is to induce children to look about them for insects, shells, minerals, flowers, etc., and to discuss in the meetings of their chapters the objects they discover, and to find out about them in accessible works on natural history. Mr. Harlan P. Ballard, of Lenox, Mass., the founder of the Society, has lately prepared a "Handbook of the St. Nicholas' Agassiz Association, designed as a guide to the study of natural objects, with directions for collecting and preserving specimens."

— The last Congress ordered the publication of the following entomological works which are now in an advanced state of